



Photos by Peter LaTourrette and PRBO

Predicting Effects of Habitat Change on Avian Communities

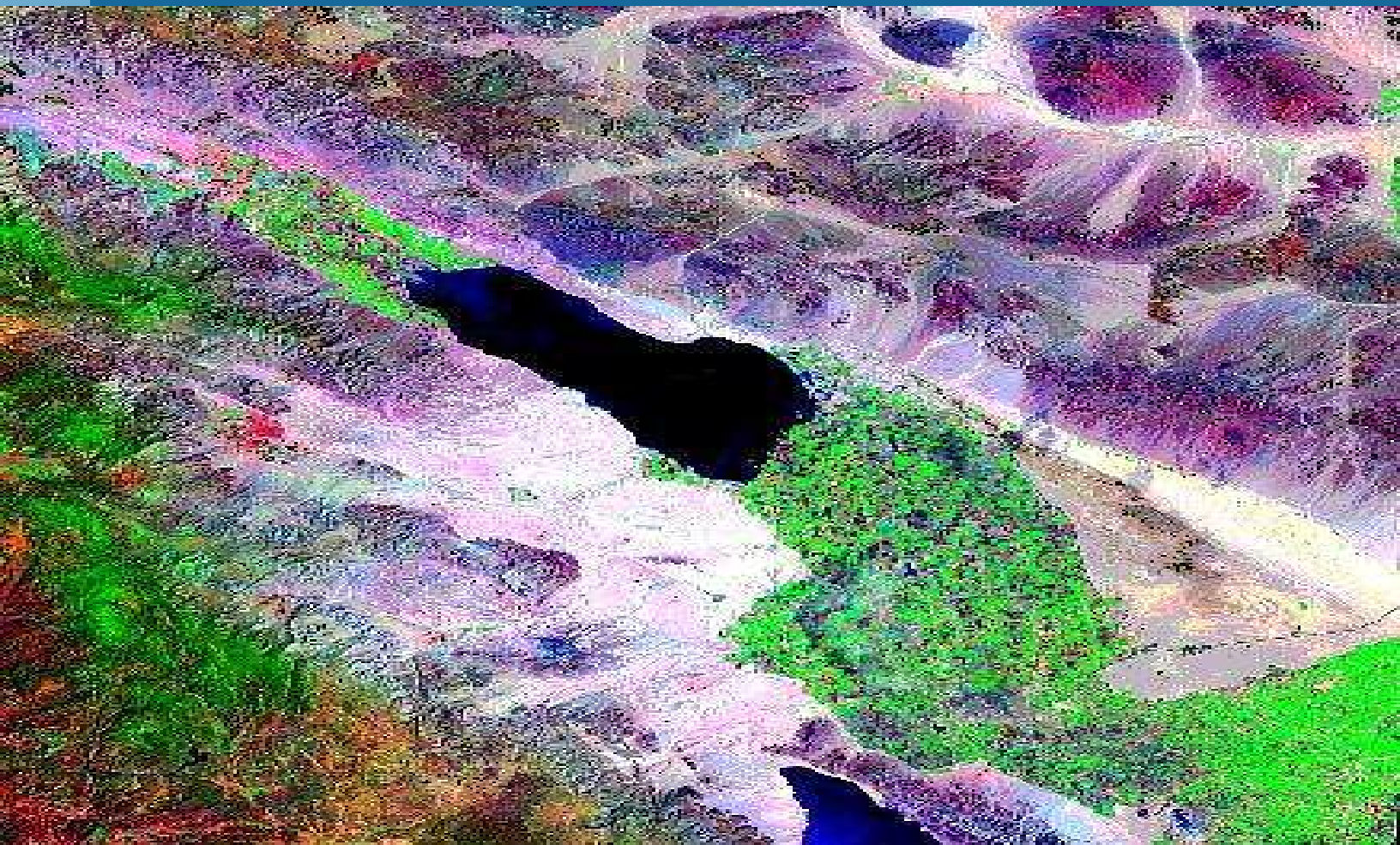
Diana Stralberg, Nils Warnock, Dave Shuford, Sam Valdez

Outline

- **Salton Sea habitat conversion model**
 - **Modeling objectives and approach**
 - **Focal species**
 - **Major habitats and model variables**
- **San Francisco Bay habitat conversion model**
 - **Background**
 - **Sample results from Phase I**

PRBO Conservation Science

Salton Sea Habitat Conversion Model



PRBO Modeling Objectives

- **Evaluate and compare the effects of specific habitat configuration alternatives on waterbirds.**
- **Identify key habitat features that may be manipulated to enhance waterbird numbers.**
- **Identify important landscape characteristics that affect waterbird habitat value.**
- **Identify optimal habitat configurations.**

PRBO Modeling Approach

- **Empirical models**
- **Static, habitat-based**
- **Assume habitat is limiting**
- **Limited to habitat / landscape characteristics that are easily quantified**
- **Predictions represent population indices for focal species and habitat-guilds**

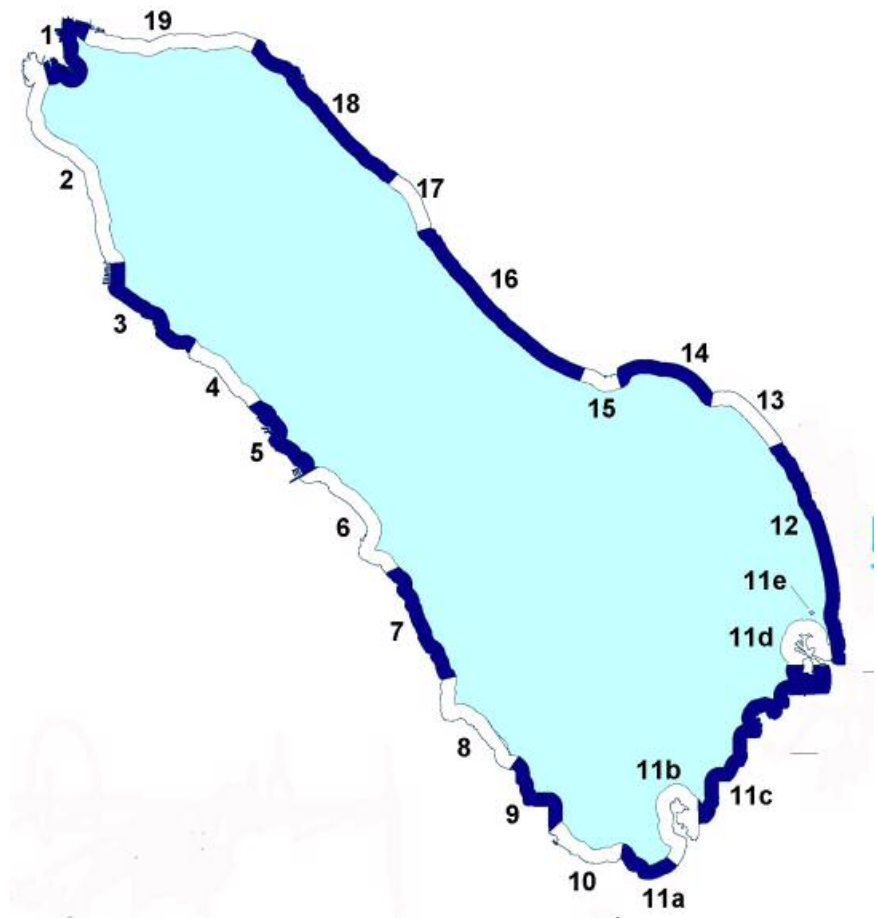
Modeling Steps

- **Develop statistical models based on 1999 bird data, field-collected habitat data, and GIS-based habitat / landscape data**
- **Provide information on important habitat and landscape characteristics**
- **Evaluate specific habitat alternatives**
- **Provide predictions of bird numbers (population indices) under each alternative (by habitat / guild and individual focal species)**

BSSC = Calif. Dept. Fish and Game Bird Species of Special Concern;	SP = US Shorebird Conservation Plan species with a 4-5 priority score
SE = state endangered; ST = State threatened	A = >10,000 birds counted on single survey (Shuford et al. 2002)
FE = Federally Endangered;	BCC = USFWS Birds of Conservation Concern - BCR 33
WP = National Waterbird Conservation Plan; species considered Highly Imperiled or of High Concern	

Shoreline / Shallow Water Bird Data

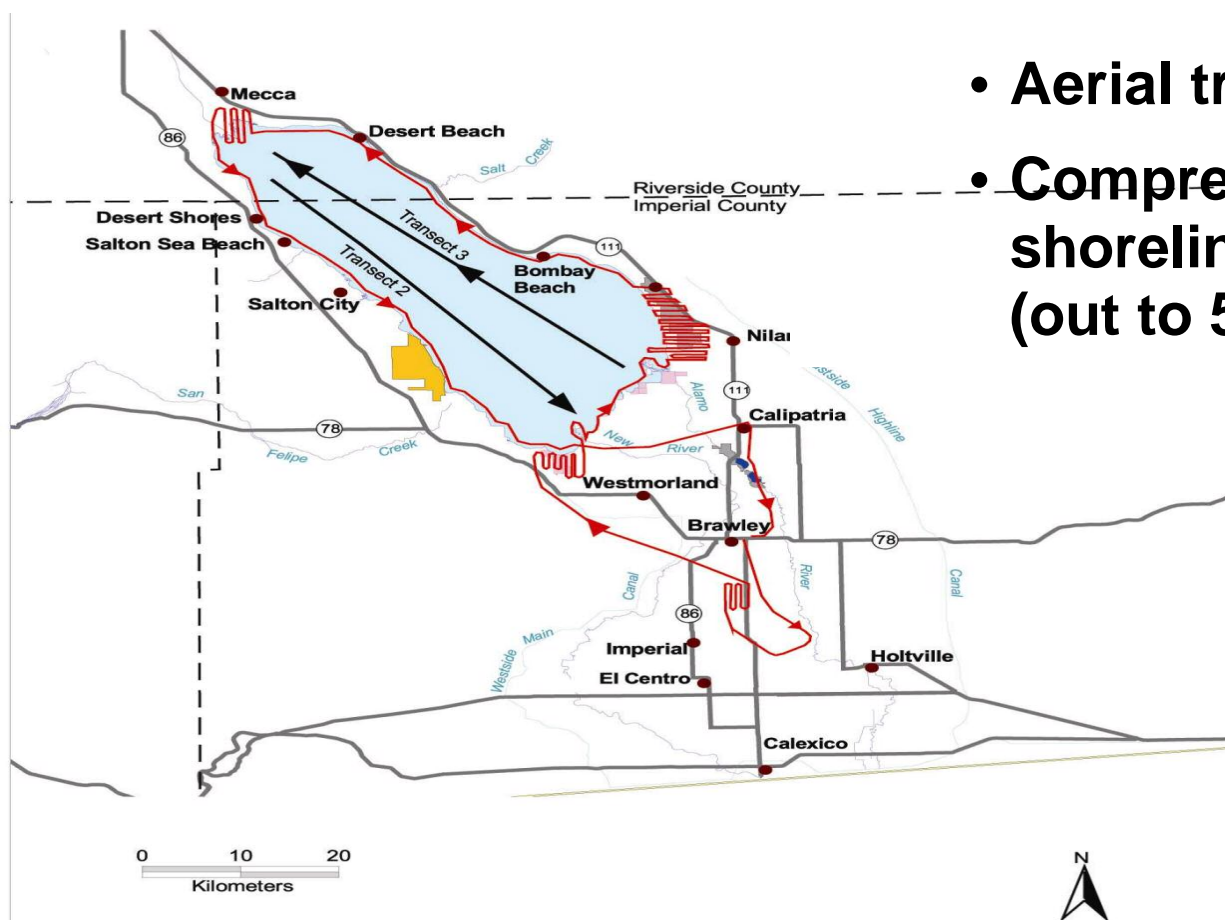
- **Comprehensive shoreline surveys (Jan, Apr, Aug, Nov 1999)**



Shoreline / Shallow Water Habitat Variables

- **Shallow water characteristics (within 500 m of shoreline)**
 - min, max, mean elevation (depth)
 - shallow proportion (< 1 ft)
 - mean slope
- **Shoreline characteristics**
 - shoreline complexity
 - proportion of wetlands within 0.5 – 1 – 5 km
 - proportion of agricultural land uses within 0.5 – 1 – 5 km
 - distance to nearest primary (deltas) and secondary (creeks) river mouth

Open Water Bird Data



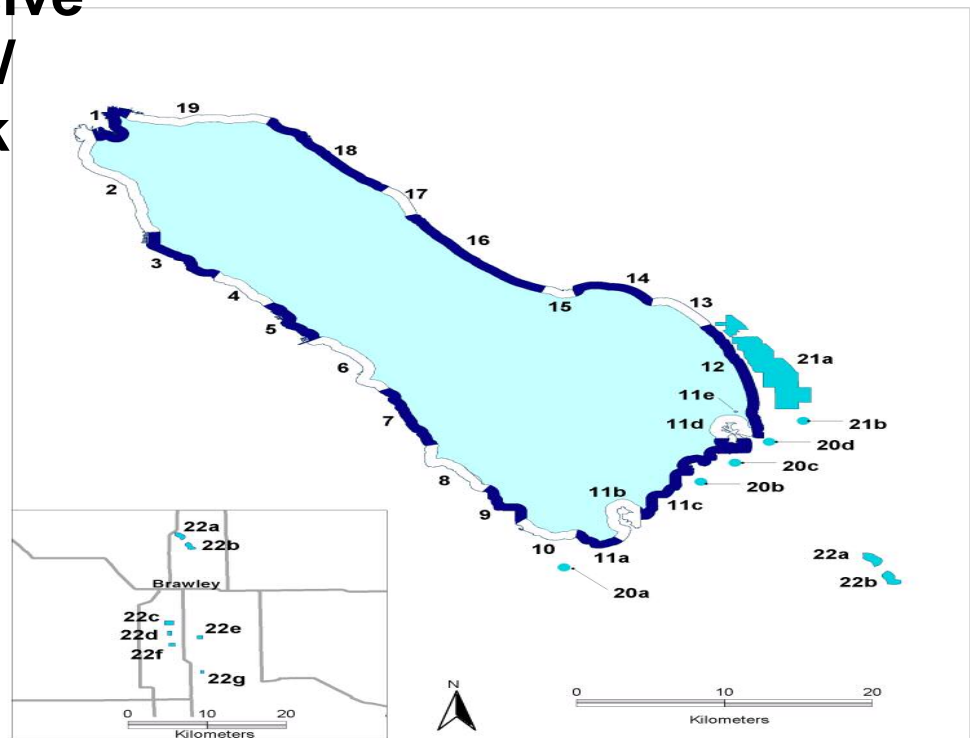
- Aerial transects
- Comprehensive shoreline surveys (out to 500 m)

Open Water Habitat Variables

- **Min, max, mean elevation (depth)**
- **Substrate characteristics (?)**
- **Distance to nearest primary (deltas) and secondary (creeks) river mouth**

Managed Marsh Bird Data

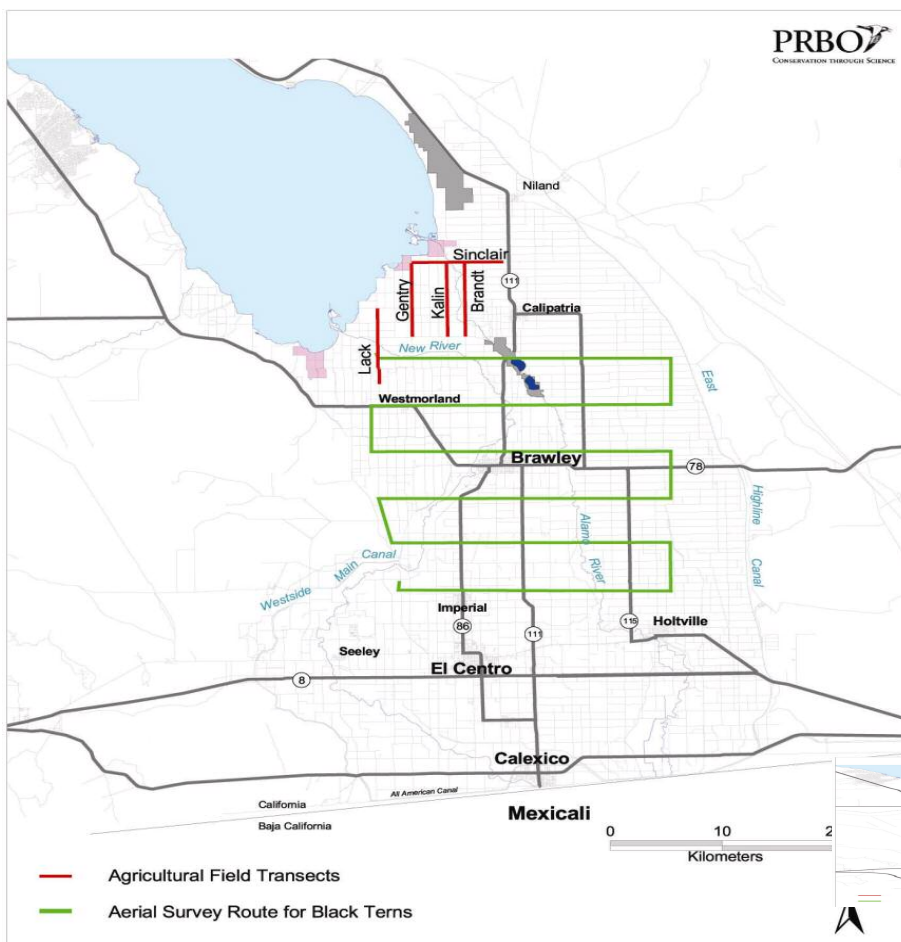
- Comprehensive wildlife area / refuge / duck club surveys
- Clapper Rail surveys



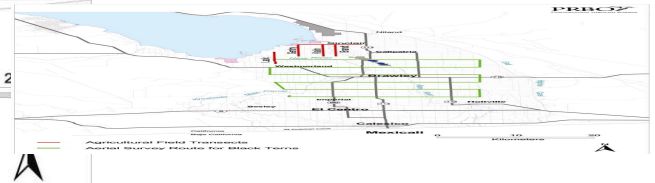
Managed Marsh Habitat Variables

- **Open water proportion (?)**
- **Vegetation height (?)**
- **Marsh size**
- **Proportion of agricultural land uses within 0.5 – 1 – 5 km**
- **Distance to nearest primary (deltas) and secondary (creeks) river mouth**

Agricultural Bird Data



- Agricultural roadside transects
- Black Tern aerial surveys
- Mountain Plover surveys



Agricultural Habitat Variables

- **Crop type**
- **Crop height**
- **Crop status (mowed, tilled, growing)**
- **Moisture (dry, partial, or full flooding)**
- **Proportion of general crop types along transect (leaf, bulb, alfalfa, grass, bare, unsuitable)**

PRBO Conservation Science

Managed Pond Bird Data

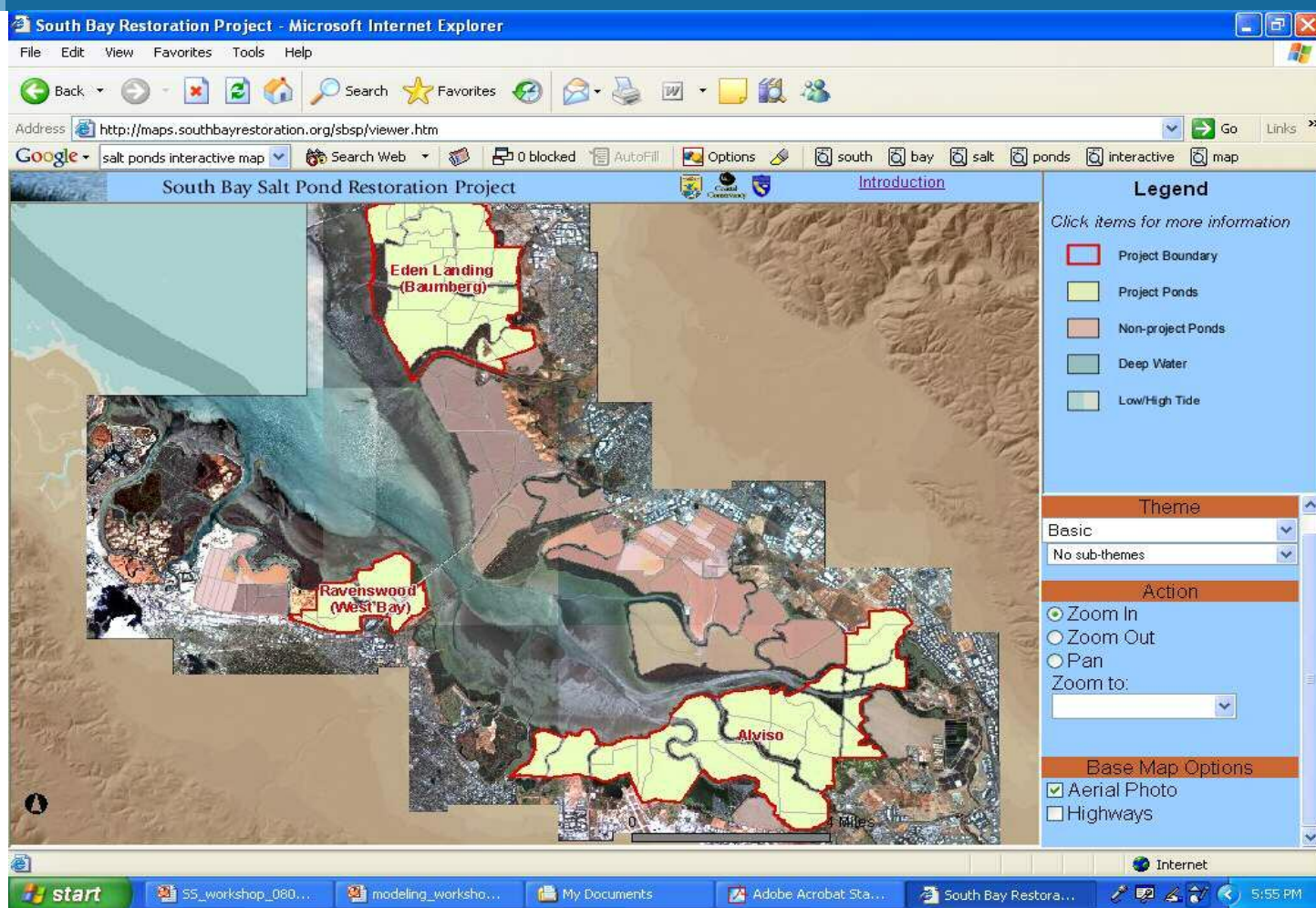
- **San Francisco Bay Salt Pond Surveys**



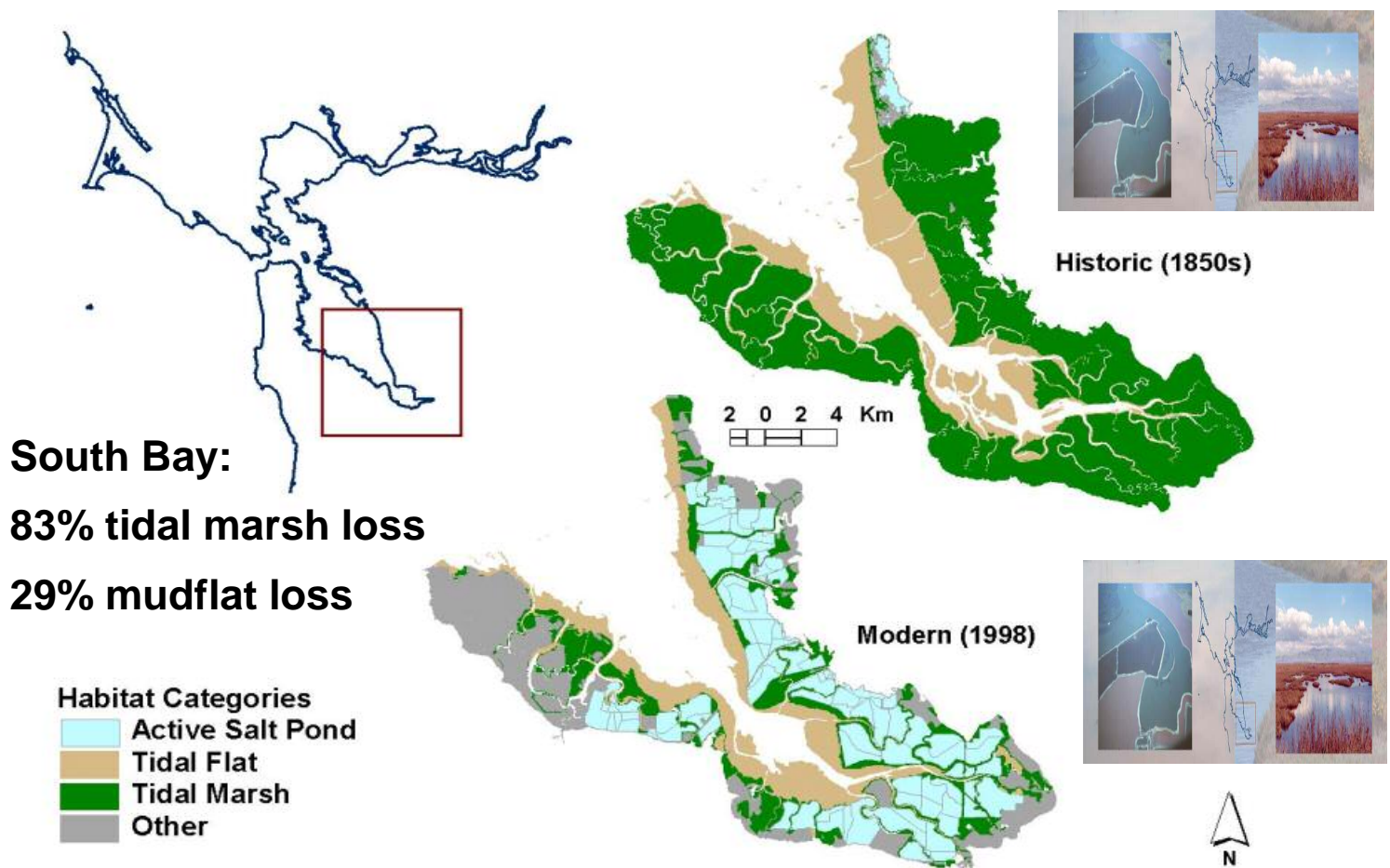
Managed Pond Habitat Variables

- **Mean depth**
- **Shallow proportion (< 15 cm)**
- **Deep proportion (> 1 m)**
- **Salinity (ppt)**
- **Pond size**
- **Surrounding land use within 1 km**

South San Francisco Bay Habitat Conversion Model

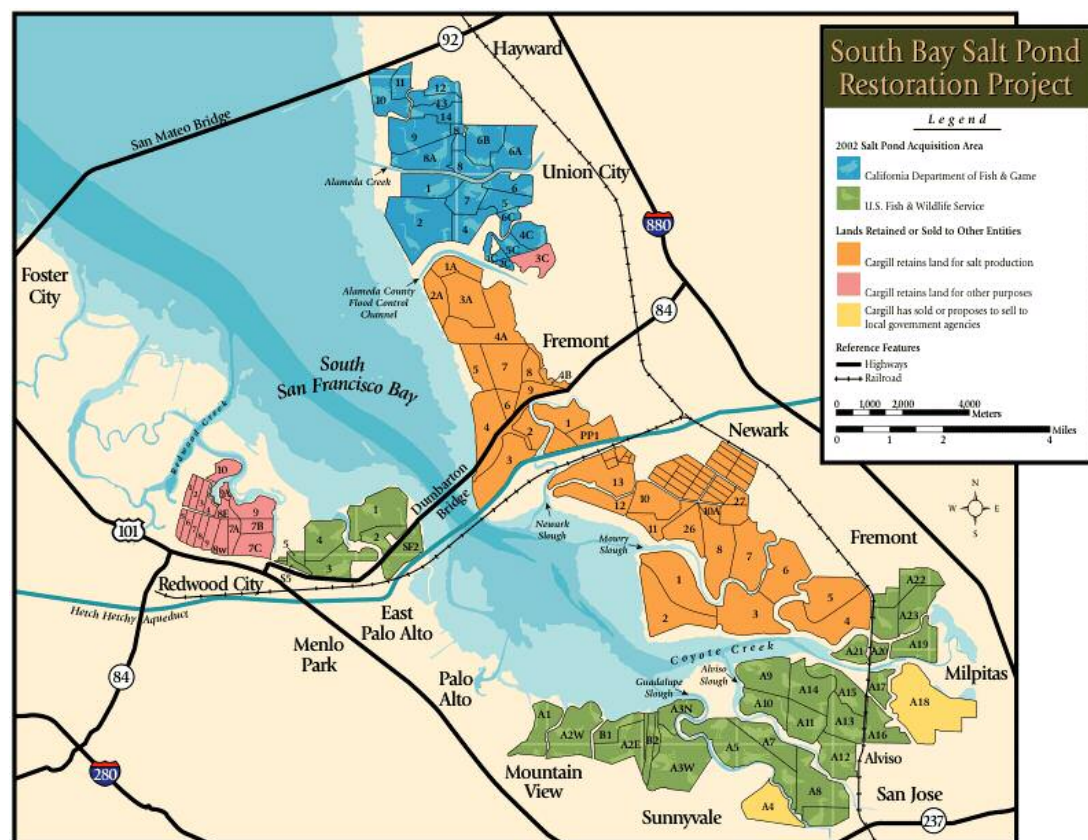


Historic Habitat Change: Diking, Filling, Dredging



Current Habitat Change: Salt Pond Restoration

- 5,471 ha of salt ponds purchased for restoration.
- Restoration and management decisions will involve trade-offs for birds.



PRBO Conservation Science

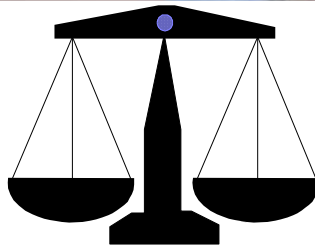
Restoration Trade-offs



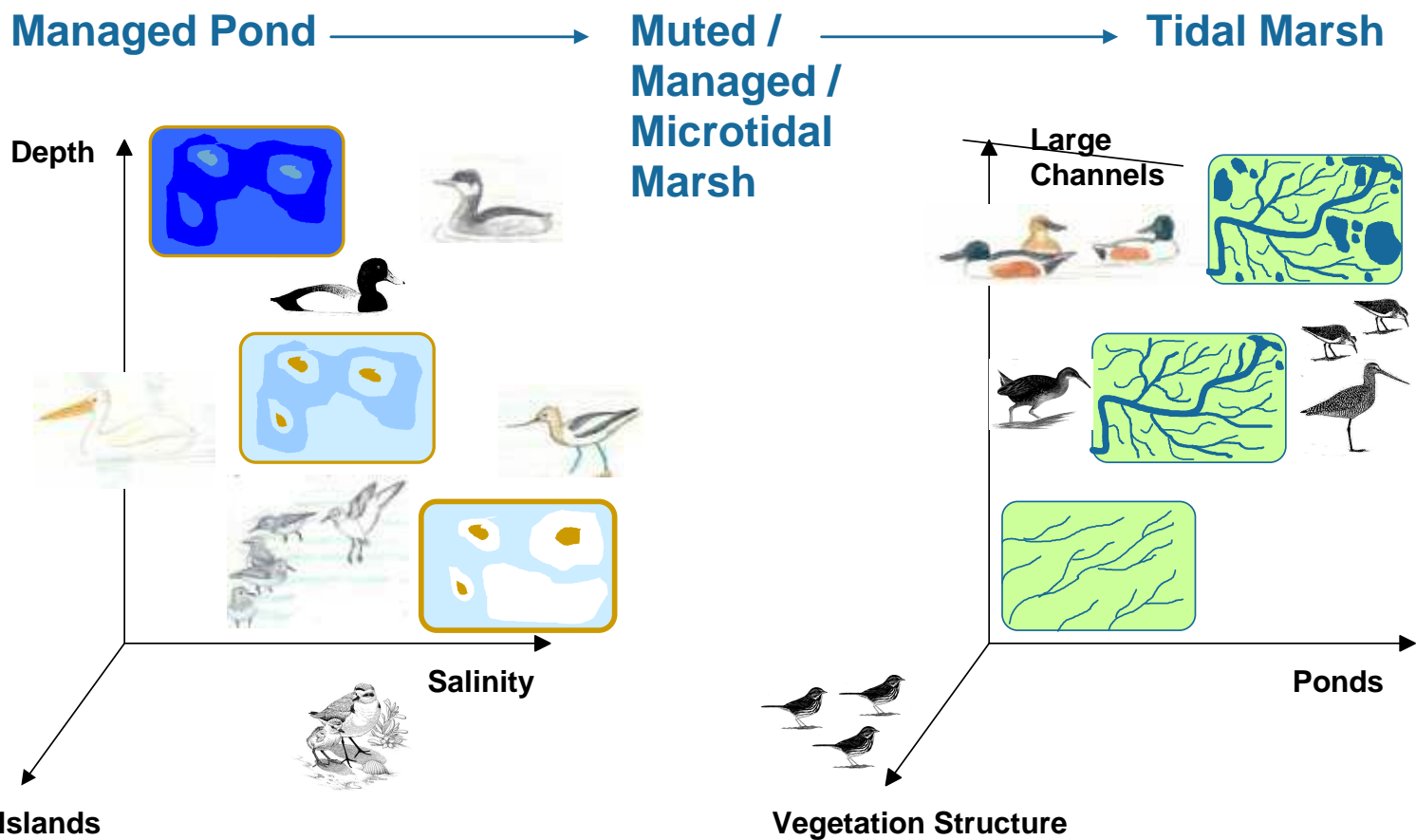
Salt Ponds



Tidal Marshes



Bird Use of Tidal and Managed Wetlands

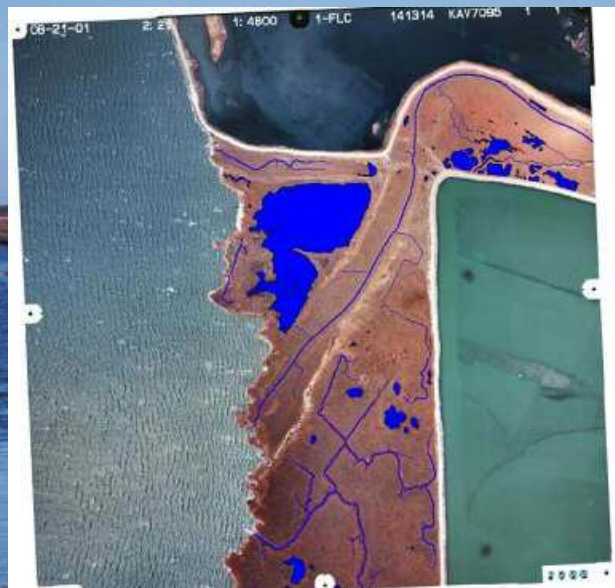


Site Characteristics



Salt Ponds

- Salinity (ppt)
- Pond size

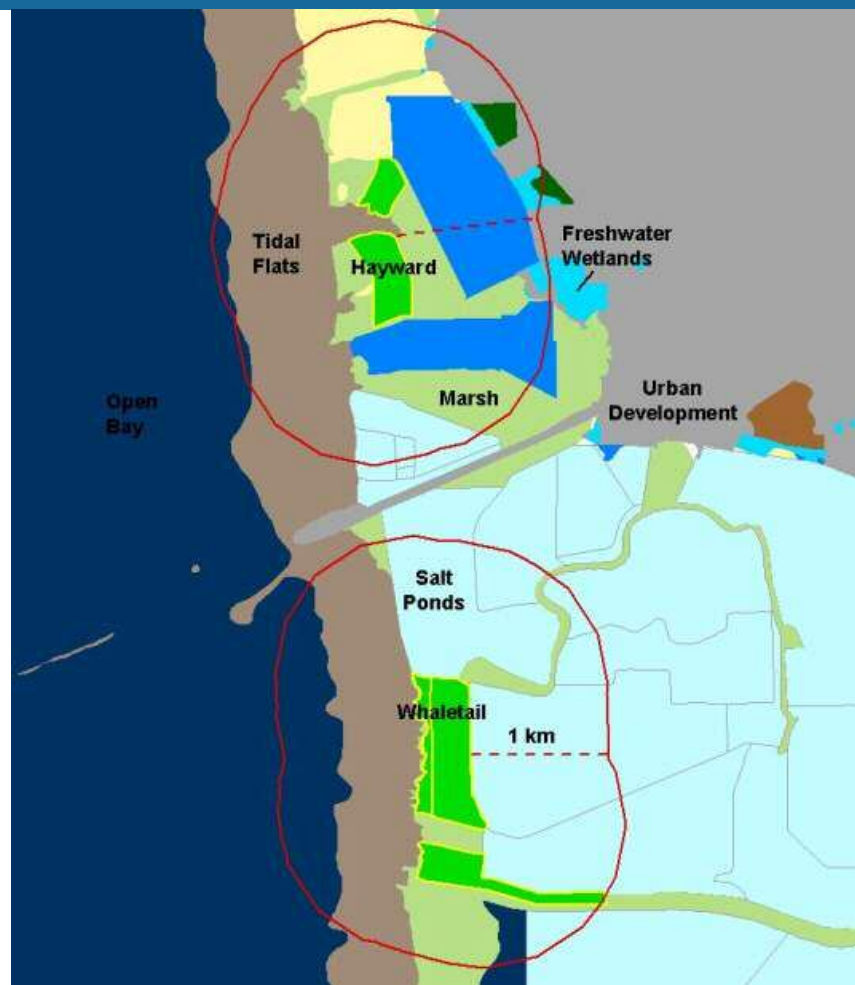


Tidal Marsh

- Channel density by width class
- Ponded area

Landscape Characteristics

- Distance to open bay, development
- Surrounding landscape composition

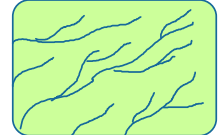


Site-level Restoration Scenarios*

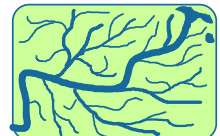
- 1: **Salt ponds** retained at current salinities (no change)
-

All salt ponds restored to tidal marsh:

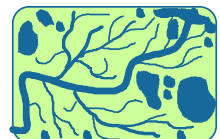
- 2: **minimum** large channels and ponded areas



- 3: **mean** large channels and ponded areas

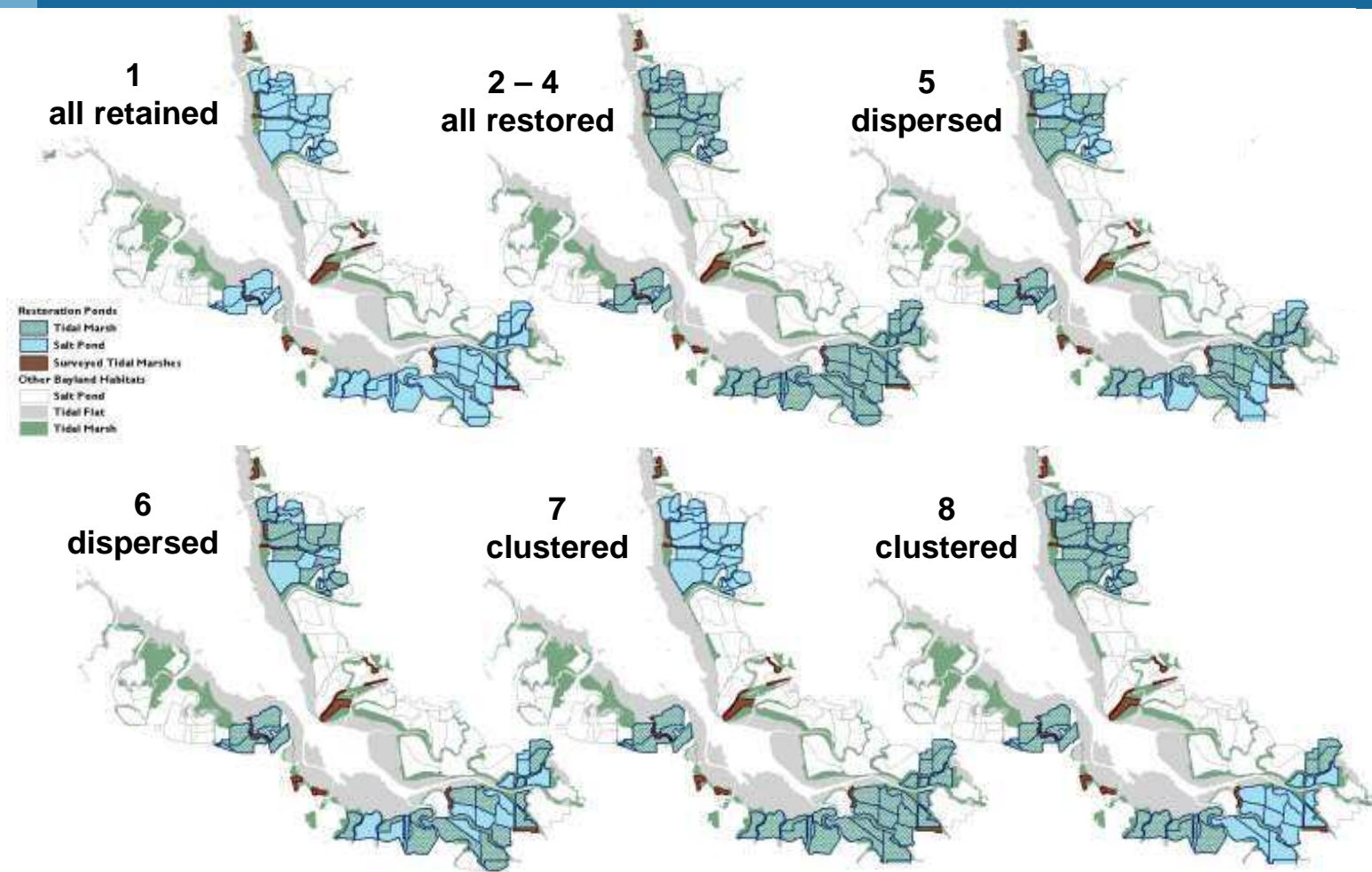


- 4: **maximum** large channels and ponded areas

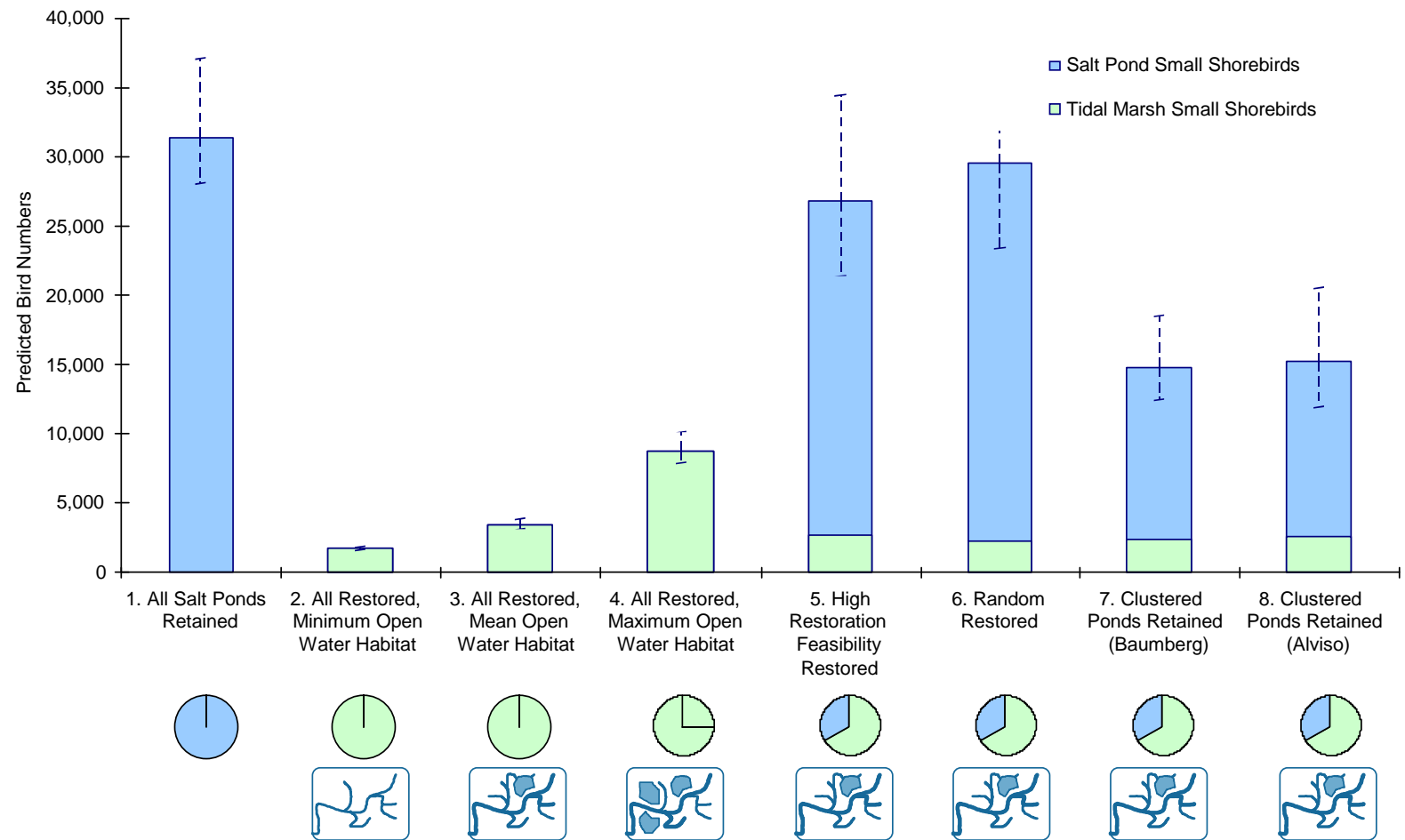


* Landscape conditions incorporated into models.

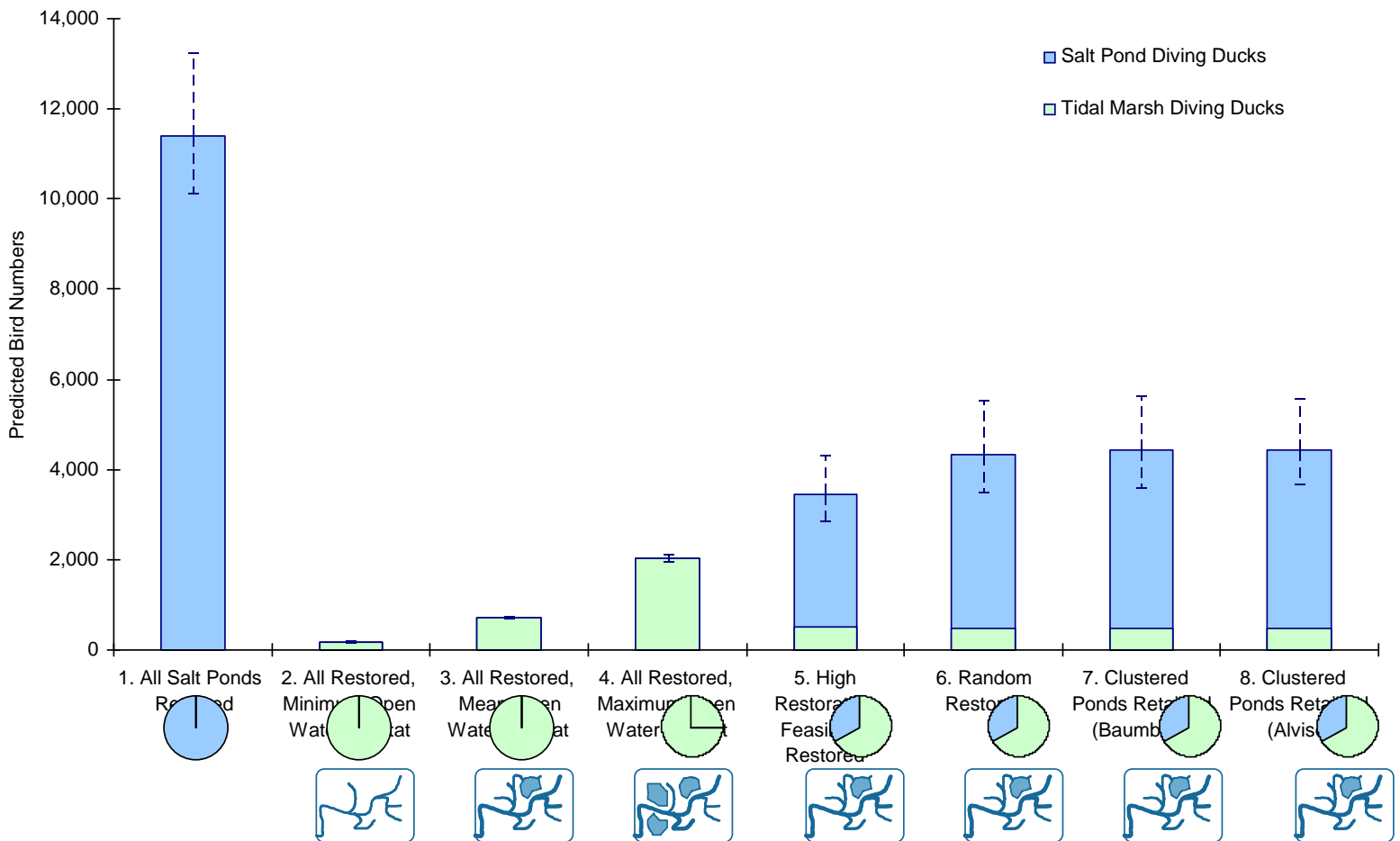
Landscape-level Restoration Scenarios



Scenario Comparisons, Small Shorebirds



Scenario Comparisons, Diving Ducks



San Francisco Bay Phase I Conclusions

- **Loss of managed ponds may cause substantial reduction in waterbird numbers, especially small shorebirds and diving ducks.**
- **Potential to reduce and/or avoid waterbird losses through design and management of individual restoration sites.**
- **Critical for waterbirds to retain some characteristics of managed ponds in a habitat mosaic (more important than tidal marsh design and management).**

San Francisco Bay Phase II Activities

- **Identification of focal species and key seasons**
- **Incorporation of salt pond bathymetry data**
- **Explicit consideration of marsh microhabitats (pond/pan, channel, vegetation)**
- **Incorporation of intertidal mudflats, open bay**
- **Approximation of carrying capacities by guild**
- **Use of information theory and model selection**
- **Evaluation of realistic restored marshes**
- **Evaluation of optimally managed ponds**

Acknowledgements

Funders:

California Coastal Conservancy
Gabilan Foundation
Mary A. Crocker Trust
Rintels Charitable Trust
Tides Foundation

Partners:

San Francisco Bay Bird Observatory
U.S. Geological Survey
U.S. Fish & Wildlife Service
(Don Edwards San Francisco Bay NWR)

prbo